

Debra M. Ikeda, MD • Ingvar Andersson, MD

## Ductal Carcinoma in Situ: Atypical Mammographic Appearances<sup>1</sup>

The authors retrospectively analyzed the mammograms of 190 women with biopsy-proved ductal carcinoma in situ (DCIS). Excluded from the current study were 117 (62%) women whose radiographs showed suspicious clustered microcalcifications, a well-known finding in DCIS. Of the remaining 73 (38%) women, 30 (16%) had negative mammograms, and 43 (23%) had mammographic manifestations of breast malignancy other than microcalcifications. Of the latter 43, 15 had circumscribed masses, and 12 had various focal nodular patterns. The remaining 16 patients showed other mammographic signs of malignancy, including asymmetry ( $n = 1$ ); dilated retroareolar ducts ( $n = 2$ ); ill-defined, rounded tumor ( $n = 2$ ); focal architectural distortion ( $n = 4$ ); subareolar mass ( $n = 3$ ); and developing density ( $n = 4$ ). Of the 73 women in the study, 60 presented with clinical findings related to the tumor. Since DCIS has a high survival rate with proper treatment, radiologists should be aware of the unusual radiographic manifestations of this disease.

**Index terms:** Breast neoplasms, 00.324 • Breast neoplasms, diagnosis, 00.324

**Radiology** 1989; 172:661-666

<sup>1</sup> From the Department of Radiology, University of Michigan Medical Center, 1500 E Medical Center Dr, Box 0326, Ann Arbor, MI 48109-0326 (D.M.I.), and the Department of Radiology, Malmö General Hospital, Malmö, Sweden (I.A.). From the 1988 RSNA annual meeting. Received November 23, 1988; revision requested January 11, 1989; revision received April 14; accepted April 19. Address reprint requests to D.M.I.

© RSNA, 1989

**T**HE ability of mammography to depict noninvasive breast cancer provides radiologists with an opportunity to diagnose carcinoma at a highly curable stage. Intraductal carcinoma, which is also called ductal carcinoma in situ (DCIS), is a form of noninvasive breast cancer. Although the natural history of DCIS is not well known (1-3), it is thought that a certain percentage of cases of DCIS will progress to invasive carcinoma. DCIS has a high survival rate when properly treated (4-10). DCIS is most commonly recognized radiographically on the basis of the presence of characteristic calcifications that form in the tumor (11,12). To examine the mammographic presentations of DCIS that are not predominantly characterized by the presence of calcifications, we reviewed the mammograms of 190 consecutive women with biopsy-proved DCIS.

### PATIENTS AND METHODS

All breast cancer patients in the city of Malmö, Sweden, are operated on at Malmö General Hospital. In an average year, 11,800 mammograms are obtained, 247 breast biopsies or mastectomies are performed, and 197 cancers are discovered there. We retrospectively reviewed the pathologic and mammographic records of all patients at Malmö General Hospital with biopsy-proved DCIS who also underwent mammography between January 1976 and March 1988. Patients included in the study had a pathologic diagnosis of DCIS (comedocarcinoma, cribriform, micropapillary, clinging, and solid types included), intracystic carcinoma, or Paget disease of the nipple with DCIS in the nipple and/or in the breast parenchyma. Patients with microinvasive or invasive carcinoma were excluded. All patients fulfilling the criteria were included in the study, regardless of the physical findings or the existence of negative mammographic findings.

Mammography was performed with conventional screen-film technique. Cranio-caudal, mediolateral oblique, and

straight lateral projections of each breast were obtained. Frequently, cone-compression spot films, magnification films, or special angled views at +10° and -10° to conventional projections were obtained to more clearly characterize a lesion. X-ray-guided fine-needle aspiration and pneumocystography, rather than breast ultrasound, are performed at Malmö General Hospital to establish whether nodules are cystic or solid. In cases of intracystic tumors, the pneumocystograms were reviewed. Galactography was also performed in five patients with bloody nipple discharge and one patient with clear nipple discharge, all of whom had negative conventional mammograms.

All cases were studied retrospectively by two radiologists who had full knowledge of the clinical presentation and the biopsy results. DCIS cases demonstrating calcifications as the main indicator of malignancy were then excluded from the study. The remaining cases either had major radiographic findings suggestive of breast cancer other than calcifications or had negative mammograms. In each case the dominant mammographic feature that characterized the cancer was identified and was correlated with the clinical history and any physical findings. Galactograms were considered positive if an intraductal filling defect or occluded duct was seen. To estimate breast density, the parenchymal pattern of the study cases was categorized with use of the Wolfe classification (13).

Radiographs of specimens were examined when available to ascertain that the mammographic lesion had been removed (35 cases). The pathologic reports and radiographs of each specimen were reviewed to assess whether the radiographic abnormality corresponded to the histologically confirmed carcinoma.

When specimen radiographs were not available, the pathologic reports were reviewed to verify that the surgically removed region correlated with the position of the suspicious mammographic abnormality or palpable mass. Problem cases were evaluated together with a pa-

**Abbreviation:** DCIS = ductal carcinoma in situ.

thologist (Folke Linell, MD, Emeritus Professor of Pathology, Malmö General Hospital), who reviewed the histologic findings (10 cases).

## RESULTS

In the study period, 190 women with the diagnosis of DCIS underwent mammography. Their ages ranged from 20 to 90 years (mean, 59 years). Calcifications were the dominant indicator of malignancy in 117 (62%) women. Their ages ranged from 29 to 90 years (mean, 58 years). These patients were subsequently excluded from the study.

The remaining 73 women with DCIS, who had either negative mammograms ( $n = 30$ ) or radiographic signs of breast cancer other than calcifications ( $n = 43$ ), were eligible for the study. Calcifications were a minor radiographic finding in two cases (one circumscribed mass and one developing density). The 73 women in the study included 60 patients with clinically abnormal findings. Of these women, 30 had negative mammograms and were operated on because of a clinically suspicious finding alone (Table 1). These patients ranged in age from 20 to 89 years (mean, 61 years). Breast parenchymal

patterns in this study group were classified as N1 in 11 women, P1 in 26 women, P2 in 21 women, and DY in 15 women (13).

## Radiographic Findings

Forty-three women (23% of all DCIS patients) had mammographic findings not classically associated with DCIS (Table 1). Fifteen circumscribed tumors (Fig 1) were found, of which seven were intracystic cancers (Fig 2). Cyst puncture showed intracystic masses by means of successful pneumocystogram in only two cases but provided specimens with posi-

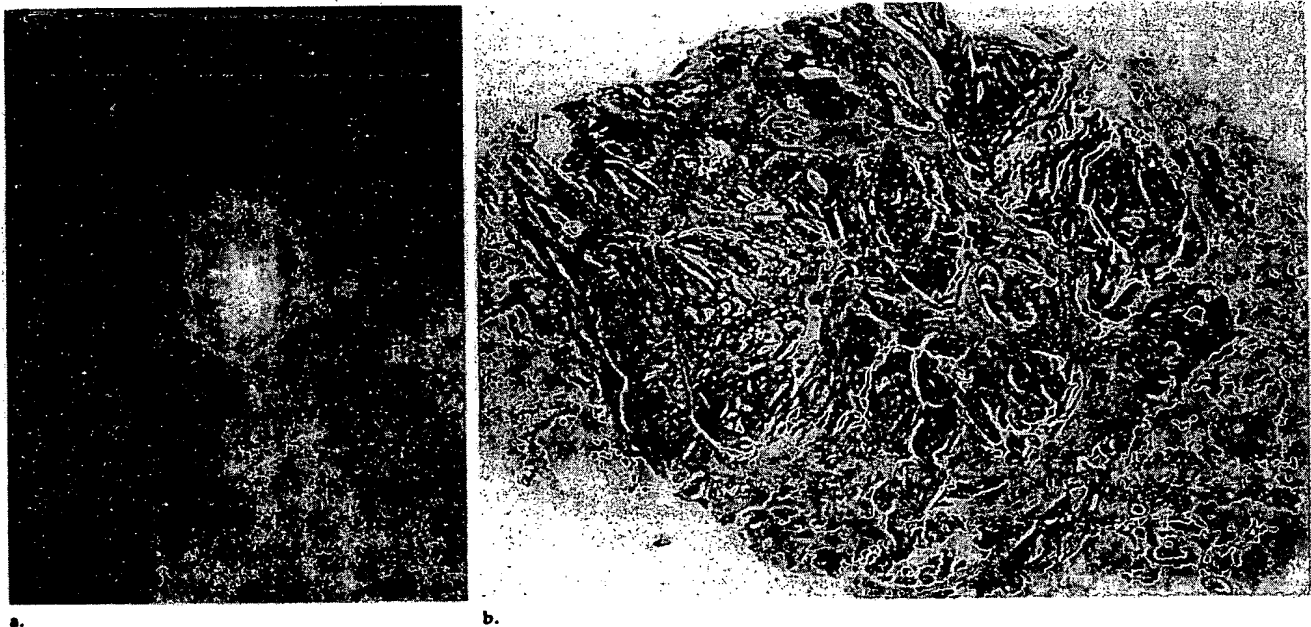
**Table 1**  
**Mammographic and Clinical Findings in 73 Women with Noncalcified DCIS**

Clinical Finding	Negative Mammogram (n = 30)	Circumscribed Mass (n = 15)	Prominent Ducts or Nodules (n = 12)	Ill-defined Mass (n = 2)	Architectural Distortion (n = 4)	Developing Density (n = 4)	Asymmetry (n = 1)	Subareolar Mass (n = 3)	Dilated Ducts (n = 2)
Palpable mass or thickening (n = 30)	9	8(5)	9(1)*	1	0	1	1	1†	0
Bloody discharge (n = 11)	6	0	1	1	0	2	0	1	0
Clear discharge (n = 1)	1	0	0	0	0	0	0	0	0
Paget disease of the nipple (n = 15)	11	0	0	0	0	1	0	1	2
Skin change (n = 3)	0	1	0	0	2	0	0	0	0
No physical findings (n = 13)	3	6(1)	2	0	2	0	0	0	0

Note.—Values are numbers of patients. Values in parentheses are numbers of patients with intracystic carcinoma.

\* Intracystic tumor appeared as a circumscribed mass; elsewhere, multifocal DCIS appeared as widened ducts.

† Also had Paget disease of the nipple.



a.

b.

**Figure 1.** (a) DCIS growing as a solid, nonpalpable, well-circumscribed 5 × 10-mm nodule (original magnification, ×3.5). (b) Tumor is seen to consist of intraductal cancerous proliferations growing between connective tissue strands (hematoxylin-eosin; original magnification, ×30).

tive or atypical cytologic findings in six of the seven intracystic carcinomas.

In 12 cases prominent ducts or nodules were the major radiographic finding. In some cases nodules formed an asymmetric focal region of "prominent duct pattern" (Fig 3). In other cases, there were several discrete nodules or the nodules had more or less coalesced into a masslike density (Figs 4, 5a). In some cases, as

in the circumscribed-tumor category, DCIS grew in several well-demarcated rounded masses or nodules (Fig 6). The microscopic correlate of this pattern was dominated by clusters of widened ducts forming nodules of varying sizes (Fig 5b).

Of four women whose mammograms showed focal architectural distortion, three had radial scars (non-encapsulated sclerosing lesions [14,15]) associated with DCIS (Fig 7).

Asymmetric density, developing densities, subareolar masses, dilated retroareolar ducts, and an ill-defined mass represented or suggested the presence of DCIS in one, four, three, two, and two cases, respectively (Figs 8-12).

Thirty patients with DCIS had negative mammograms (16% of all DCIS patients, including those with calcifications). This group included almost all study women with Paget disease of the nipple and the majority of the patients who presented with bloody discharge (Table 1). Surprisingly, over half ( $n = 19$ ) of the women with negative mammograms had Wolfe patterns classified as either N1 or P1; the remainder were classified as having P2 or DY patterns.

Five of the six patients with negative mammograms and bloody discharge and one with a negative mammogram and with atypical cytologic findings at examination of clear nipple discharge underwent galactography. This procedure demonstrated an intraductal filling defect or an occluded duct in five of six patients. The remaining two patients underwent surgical biopsy on the basis of atypical cytologic findings at study of nipple discharge.

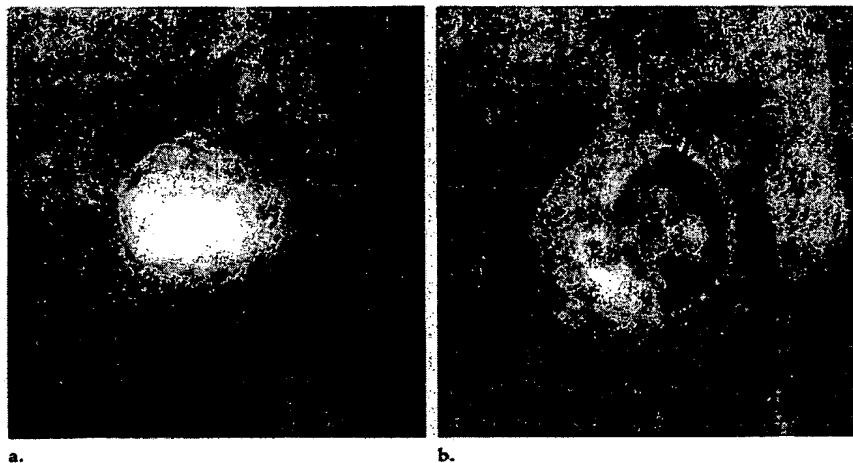


Figure 2. (a) Nonpalpable, 1.7-cm intracystic tumor prior to puncture is similar in appearance to the solid tumor in Figure 1a (original magnification,  $\times 1.8$ ). (b) Pneumocystogram demonstrates the intracystic carcinoma outlined by air (arrow).

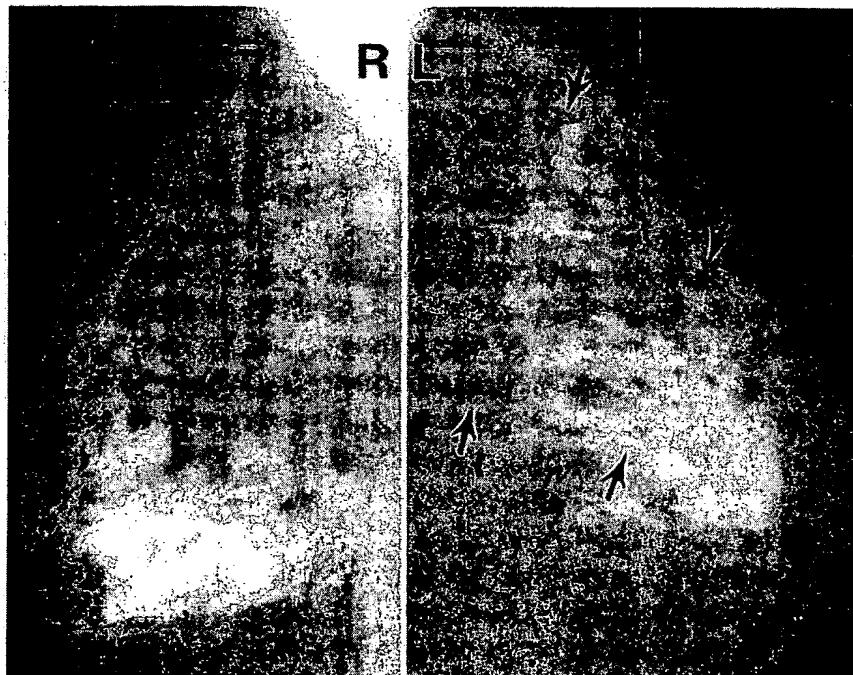


Figure 3. DCIS appearing as a nonpalpable, asymmetric "prominent duct" pattern in the upper portion of the left breast (arrows). R = right, L = left.

### Clinical Findings

The most common presenting symptoms in the 73 women were a palpable mass (41%), Paget disease of the nipple (21%), or a history of bloody nipple discharge (15%). Thirteen cancers were identified in patients without physical findings; three carcinomas were seen mammographically in patients referred for breast pain, and seven were discovered at routine screening mammography. Three nonpalpable mammographically occult cancers were found at pathologic study of material from patients undergoing subcutaneous mastectomy performed prophylactically because of a strong family history of breast cancer (one patient) or because of cosmetic reasons due to prior contralateral mastectomy for carcinoma (two patients).

Most women (11 of 15) with Paget disease of the nipple and DCIS had negative mammograms without radiographic findings of skin or nipple thickening, even in retrospect. The only atypical mammographic presentations of DCIS associated with Paget disease of the nipple included asymmetric density, subareolar mass, or dilated retroareolar ducts. In the nonstudy group, two women with

Paget disease of the nipple had calcified DCIS.

#### Extent of Disease

Forty-three of the 73 women had multifocal or widespread disease. Of these, 18 had negative mammograms, and four had bilateral disease. Twenty-two women had localized disease, and eight women had DCIS in the nipple only.

#### DISCUSSION

Our results show that a considerable proportion of cases of DCIS are associated with radiographic findings other than microcalcifications.

The less common mammographic signs of breast malignancy have been described by other investigators (16-20), but their relative frequency in association with DCIS has not, to our knowledge, been assessed. Our data

indicate that when DCIS is associated with findings other than calcifications, a variety of radiologic appearances can result, most commonly a circumscribed mass or clustered nodules. DCIS may appear as focal asymmetric regions of widened ducts and nodules, which can sometimes simulate a normal mammographic variant. Our findings indicate that when an asymmetric prominent ductal or nodular pattern is associated with a palpable mass or bloody discharge, the constellation of findings should be considered suggestive of malignancy.

Negative mammography did not exclude the presence of DCIS in 30 patients, supporting the well-known fact that in such cases further clinical, cytologic, or histologic examination



Figure 4. DCIS appearing as a large, palpable, asymmetric, masslike region containing several 2-3-mm nodules in the upper portion of the left breast (arrows). R = right, L = left.

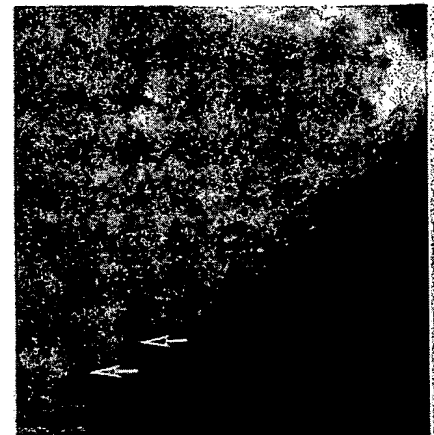


Figure 6. DCIS growing as discrete, well-circumscribed nodules near the right infra-mammary fold (arrows).

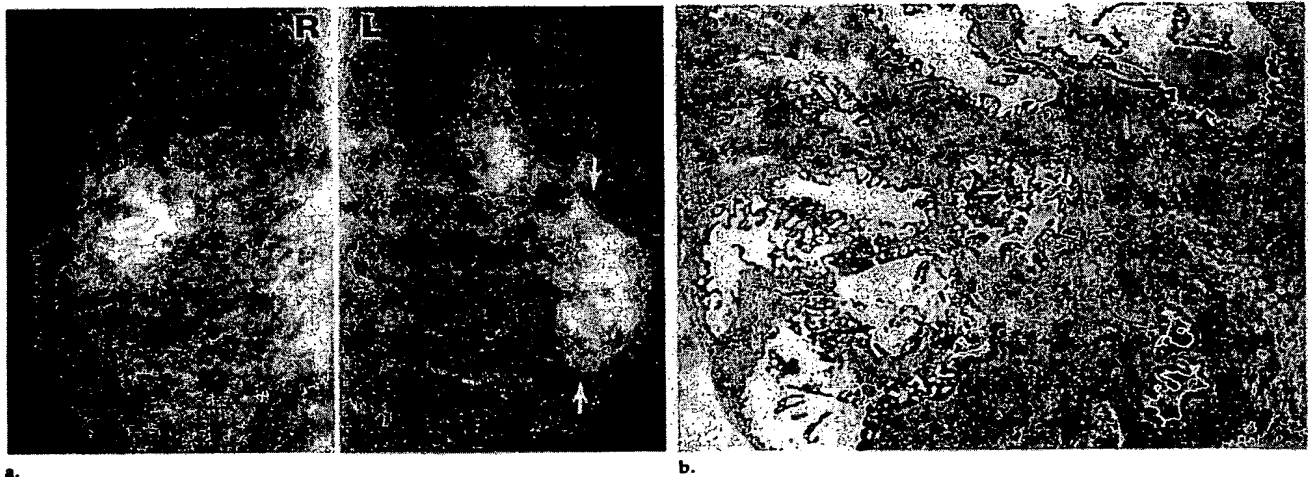


Figure 5. (a) DCIS growing as a palpable, asymmetric, focal conglomeration of widened retroareolar ducts or nodules in the left breast (arrows). R = right, L = left. (b) Same patient as in a. Ectatic ducts are surrounded by fibrotic, sclerotic mantles with intraductal growth of mural and bridging carcinoma (hematoxylin-eosin; original magnification, X60).

is warranted if a mass, Paget disease of the nipple, or bloody nipple discharge is present. In patients with negative mammograms and a history of bloody discharge, galactography may be helpful in confirming the presence of a lesion and in locating the involved quadrant for the surgeon.

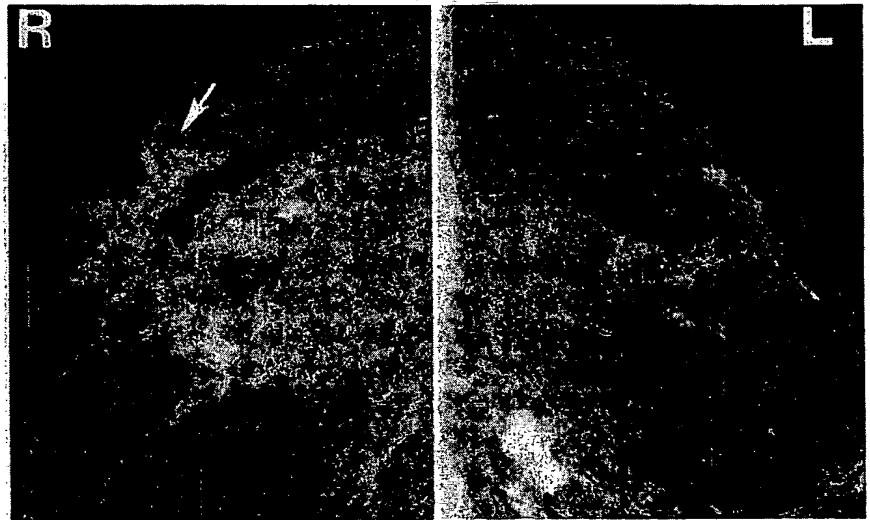
Until recently, DCIS accounted for only up to 5% of all carcinomas (1) and was considered a relatively uncommon lesion. DCIS usually was an incidental finding in breast speci-

mens of women who were undergoing breast biopsy for an unrelated reason or who presented clinically with a mass. The use of modern equipment has resulted in improved mammographic image quality, and breast-cancer screening programs are now detecting smaller and smaller lesions. DCIS accounted for 13.8%–20% of all cancers detected in three large, population-based mammographic screening trials (21–23).

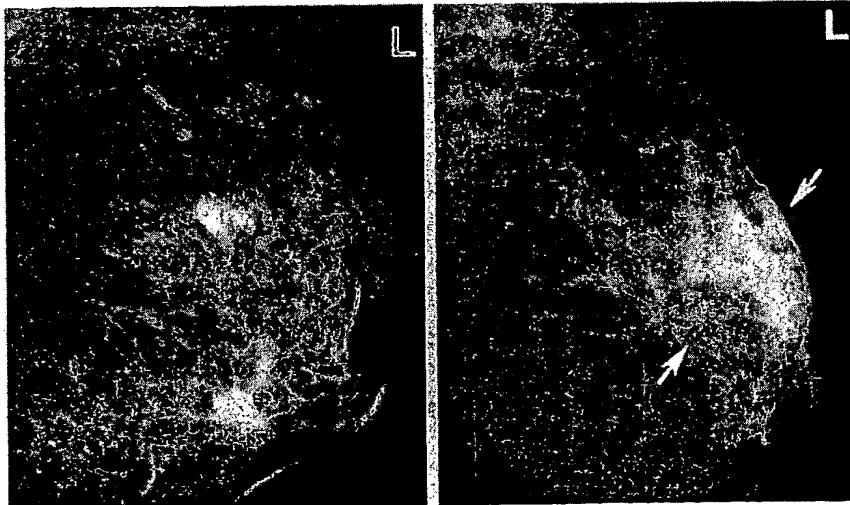
In a radiographic study by Der-shaw et al (24), in which 54 cases of mammographically detected DCIS were reviewed, 37 lesions were characterized by microcalcifications alone, and 16 additional tumors appeared as calcifications in a mass, for a total of 98% of all study cases, as opposed to only 62% of all DCIS cases characterized by calcifications in our study. The disparity in the percentage of calcified lesions can be attrib-



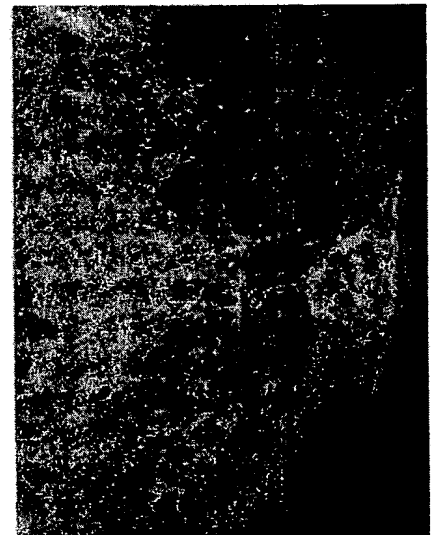
**Figure 7.** Radial scar associated with DCIS produces architectural distortion in 1-cm nonpalpable lesion found at routine mammography in a 50-year-old woman (original magnification,  $\times 1.7$ ).



**Figure 8.** Mediolateral mammogram shows DCIS producing palpable asymmetry of dense tissue (arrow) in the upper portion of the right breast of a 43-year-old woman. The rest of the dense glandular tissue contained only two additional tiny foci of DCIS. R = right, L = left.



**Figure 9.** (a) Oblique projection of screening mammographic examination of a 71-year-old woman demonstrates a normal left breast with focal areas of density. (b) Twenty-one months later, increased density is seen at the site of a palpable mass (arrows). Extensive DCIS found at surgery. L = left.



**Figure 10.** Lateral view of the breast shows a 1-cm subareolar mass in a 71-year-old woman with Paget disease of the nipple.



**Figure 11.** Lateral mammogram shows dilated ducts in the retroareolar region in a 70-year-old woman with Paget disease and DCIS of the nipple.



**Figure 12.** Palpable, 1.7-cm, ill-defined mass representing DCIS is seen on this craniocaudal view of an 82-year-old woman (original magnification, X2).

uted mostly to patient selection; by definition, all women in the former study were selected on the basis of needle localization of nonpalpable mammographic lesions. This does not apply to our study population, which includes all DCIS cases (including mammographically occult lesions) irrespective of clinical or radiographic mode of diagnosis. Had the selection criteria of Dershaw et al (24) been used in our study, the 60

women with palpable or other clinical findings (including 30 women with negative mammograms) would have been excluded. In addition, the histologic definition of DCIS in the two studies may not be identical, since our study included the rare intracystic carcinoma and DCIS associated with Paget disease of the nipple. These types of DCIS may not have been included in the Dershaw et al investigation.

Mastectomy has been the traditional treatment of choice for DCIS, due to its efficacy in tumor control (6,7). Some patients with DCIS are now offered breast-conserving surgery, sometimes with subsequent radiation therapy, since recent data indicate a reasonably high level of local tumor control with these treatments (6-10). Since DCIS tends to be multifocal (25,26), breast-conserving treatment requires careful preoperative evaluation (6-10), in which mammography plays an important role. Knowledge of the mammographic spectrum of DCIS will be useful in both the identification of this condition and the preoperative evaluation of the extent of disease. ■

#### References

- Schnitt SJ, Silen W, Sadowsky NL, Connolly JL, Harris JR. Ductal carcinoma in situ (intraductal carcinoma) of the breast. *N Engl J Med* 1988; 318:898-903.
- Gump FE, Jicha DL, Ozello L. Ductal carcinoma in situ (DCIS): a revised concept. *Surgery* 1987; 102:790-795.
- Page DL, Dupont WD, Rogers LW, Landenberger M. Intraductal carcinoma of the breast: follow-up after biopsy only. *Cancer* 1982; 49:751-758.
- Schuh ME, Nemoto T, Penetrante RB, Rosner D, Dao TL. Intraductal carcinoma: analysis of presentation, pathologic findings and outcome of disease. *Arch Surg* 1986; 121:1303-1307.
- Rosner D, Bedwani RN, Vana J, Baker HW, Murphy GP. Non-invasive breast carcinoma: results of a national survey by the American College of Surgeons. *Ann Surg* 1980; 192:139-147.
- Sunshine JA, Moseley HS, Fletcher WS, Krippaehne WW. Breast carcinoma in situ: a retrospective review of 112 cases with a minimum 10 year follow-up. *Am J Surg* 1985; 150:44-51.
- Fisher ER, Sass R, Fisher B, Wicherham L, Paik SM. Pathologic findings from the National Surgical Adjuvant Breast Project (protocol 6). I. Intraductal carcinoma (DCIS). *Cancer* 1986; 57:197-208.
- Recht A, Danoff BS, Solin LJ, et al. Intraductal carcinoma of the breast: results of treatment with excisional biopsy and irradiation. *J Clin Oncol* 1985; 3:1339-1343.
- Zanfrani B, Fourquet A, Vilcoq JR, Legal M, Calle R. Conservative management of intraductal breast carcinoma with tumor-ectomy and radiation therapy. *Cancer* 1986; 57:1299-1301.
- Montague ED. Conservation surgery and radiation therapy in the treatment of operable breast cancer. *Cancer* 1984; 53(suppl 3):700-704.
- Sigfússon BF, Andersson I, Aspegren K, Janzon L, Linell F, Ljungberg O. Clustered breast calcifications. *Acta Radiol [Diagn] (Stockh)* 1983; 24:273-281.
- Jotti GS, Petit JY, Contesso G. Minimal breast cancer: a clinically meaningful term? *Semin Oncol* 1986; 13:384-392.
- Wolfe JN. Xeroradiography of the breast. 2nd ed. Springfield, Ill: Thomas, 1983; 48-126.
- Fisher ER, Palekar AS, Kotwal N, Lipana N. A non-encapsulated sclerosing lesion of the breast. *Am J Clin Pathol* 1979; 71:240-246.
- Linell F, Ljungberg O, Andersson I. Breast carcinoma: aspects of early stages, progression and related problems. *Acta Pathol Microbiol Scand [A]* 1980; 272(suppl):14-63.
- Martin JE, Gallager HS. Mammographic diagnosis of minimal breast cancer. *Cancer* 1971; 28:1519-1526.
- Tábar L, Dean PB. Teaching atlas of mammography. New York: Thieme-Stratton, 1983; 6-14, 138-139.
- Wolfe JN. Mammography: ducts as a sole indicator of breast carcinoma. *Radiology* 1967; 89:206-210.
- Sickles EA. Mammographic features of "early" breast cancer. *AJR* 1984; 143:461-464.
- Sickles EA. Mammographic features of 300 consecutive nonpalpable breast cancers. *AJR* 1986; 146:661-663.
- Andersson I. Radiographic screening for breast carcinoma. II. Prognostic considerations on the basis of a short-term follow-up. *Acta Radiol [Diagn] (Stockh)* 1981; 22:227-233.
- Verbeek ALM, Hendriks JHCL, Holland R, et al. Reduction of breast cancer mortality through mass screening with modern mammography: first results of Nijmegen Project, 1975-1981. *Lancet* 1984; 1:1222-1224.
- Baker LH. Breast Cancer Detection Demonstration Project: five-year summary report. *CA* 1982; 32:194-225.
- Dershaw DD, Abramson A, Kinne DW. Ductal carcinoma in situ: mammographic findings and clinical implications. *Radiology* 1989; 170:411-415.
- Lagios MD, Westdahl PR, Margolin FR, Rose MR. Duct carcinoma in situ: relationship of extent of noninvasive disease to the frequency of occult invasion, multicentricity, lymph node metastases, and short-term treatment failures. *Cancer* 1982; 50:1309-1314.
- Ringberg A, Palmer B, Linell F. The contralateral breast at reconstructive surgery after breast cancer operations: a histopathological study. *Breast Cancer Res Treatment* 1982; 2:151-161.